1. What are the *possible Integer* roots of the polynomial below?

$$f(x) = 6x^3 + 6x^2 + 3x + 3$$

A. All combinations of: $\dfrac{\pm 1, \pm 2, \pm 3, \pm 6}{\pm 1, \pm 3}$

B. All combinations of: $\dfrac{\pm 1, \pm 3}{\pm 1, \pm 2, \pm 3, \pm 6}$

C. $\pm 1, \pm 3$

D. $\pm 1, \pm 2, \pm 3, \pm 6$

E. There is no formula or theorem that tells us all possible Integer roots.

---

2. Factor the polynomial below completely. Then, choose the intervals the zeros of the polynomial belong to, where $z_1 \leq z_2 \leq z_3$. *To make the problem easier, all zeros are between -5 and 5.*

$$f(x) = 10x^3 + 69x^2 + 126x + 40$$

A. $z_1 \in [0.5, 0.51]$, $z_2 \in [1.71, 2.09]$, and $z_3 \in [3, 8]$

B. $z_1 \in [-4.04, -3.94]$, $z_2 \in [-2.53, -2.26]$, and $z_3 \in [-0.4, 1.6]$

C. $z_1 \in [-4.04, -3.94]$, $z_2 \in [-2.53, -2.26]$, and $z_3 \in [-0.4, 1.6]$

D. $z_1 \in [0.26, 0.44]$, $z_2 \in [2.47, 2.97]$, and $z_3 \in [3, 8]$

E. $z_1 \in [0.26, 0.44]$, $z_2 \in [2.47, 2.97]$, and $z_3 \in [3, 8]$

---

3. Factor the polynomial below completely, knowing that $x - 5$ is a factor. Then, choose the intervals the zeros of the polynomial belong to, where $z_1 \leq z_2 \leq z_3 \leq z_4$. *To make the problem easier, all zeros are between -5 and 5.*

$$f(x) = 9x^4 - 72x^3 + 143x^2 - 20x - 100$$

A. $z_1 \in [-1.83, -1.34]$, $z_2 \in [0, 1.3]$, $z_3 \in [1.98, 2.07]$, and $z_4 \in [4.67, 5.09]$

B. $z_1 \in [-5.3, -4.93]$, $z_2 \in [-2.3, -1.3]$, $z_3 \in [-0.62, -0.59]$, and $z_4 \in [1.38, 1.7]$

C. $z_1 \in [-0.84, -0.37]$, $z_2 \in [0.9, 3.3]$, $z_3 \in [1.98, 2.07]$, and $z_4 \in [4.67, 5.09]$

D. $z_1 \in [-5.3, -4.93]$, $z_2 \in [-2.3, -1.3]$, $z_3 \in [-0.56, -0.53]$, and $z_4 \in [1.66, 2.22]$

E. $z_1 \in [-5.3, -4.93]$, $z_2 \in [-2.3, -1.3]$, $z_3 \in [-1.73, -1.65]$, and $z_4 \in [0.46, 1.24]$

---

4. Factor the polynomial below completely, knowing that $x-2$ is a factor. Then, choose the intervals the zeros of the polynomial belong to, where $z_1 \leq z_2 \leq z_3 \leq z_4$. *To make the problem easier, all zeros are between -5 and 5.*

$$f(x) = 20x^4 - 127x^3 + 94x^2 + 235x - 150$$

A. $z_1 \in [-5, -4.55]$, $z_2 \in [-2.9, -0.1]$, $z_3 \in [-0.71, -0.18]$, and $z_4 \in [1, 1.45]$

B. $z_1 \in [-1.28, -1.03]$, $z_2 \in [0, 1.5]$, $z_3 \in [1.97, 2.15]$, and $z_4 \in [4.9, 5.35]$

C. $z_1 \in [-5, -4.55]$, $z_2 \in [-3.9, -2.1]$, $z_3 \in [-2.2, -1.98]$, and $z_4 \in [-0.37, 0.46]$

D. $z_1 \in [-5, -4.55]$, $z_2 \in [-2.9, -0.1]$, $z_3 \in [-1.86, -1.52]$, and $z_4 \in [0.53, 0.99]$

E. $z_1 \in [-1.21, -0.52]$, $z_2 \in [1.5, 1.8]$, $z_3 \in [1.97, 2.15]$, and $z_4 \in [4.9, 5.35]$

---

5. Perform the division below. Then, find the intervals that correspond to the quotient in the form $ax^2 + bx + c$ and remainder r.

$$\frac{8x^3 - 10x^2 - 32x + 43}{x + 2}$$

A. $a \in [7, 9]$, $b \in [-36, -33]$, $c \in [67, 76]$, and $r \in [-172, -165]$.

B. $a \in [-19, -14]$, $b \in [22, 23]$, $c \in [-78, -74]$, and $r \in [195, 200]$.

C. $a \in [-19, -14]$, $b \in [-45, -41]$, $c \in [-120, -112]$, and $r \in [-189, -187]$.

D. $a \in [7, 9]$, $b \in [-26, -23]$, $c \in [19, 25]$, and $r \in [2, 11]$.

E. $a \in [7, 9]$, $b \in [4, 13]$, $c \in [-23, -14]$, and $r \in [2, 11]$.

---

6. Perform the division below. Then, find the intervals that correspond to the quotient in the form $ax^2 + bx + c$ and remainder r.

$$\frac{15x^3 + 63x^2 - 43}{x + 4}$$

A. $a \in [14, 18], b \in [-3, 5], c \in [-14, -8]$, and $r \in [5, 9]$.

B. $a \in [14, 18], b \in [120, 126], c \in [492, 495]$, and $r \in [1925, 1931]$.

C. $a \in [14, 18], b \in [-13, -8], c \in [60, 61]$, and $r \in [-348, -342]$.

D. $a \in [-64, -57], b \in [-184, -173], c \in [-709, -707]$, and $r \in [-2875, -2869]$.

E. $a \in [-64, -57], b \in [303, 307], c \in [-1213, -1210]$, and $r \in [4803, 4809]$.

---

7. Perform the division below. Then, find the intervals that correspond to the quotient in the form $ax^2 + bx + c$ and remainder r.

$$\frac{4x^3 + 12x^2 - 11}{x + 2}$$

A. $a \in [-8, -6], b \in [22, 32], c \in [-60, -55]$, and $r \in [101, 107]$.

B. $a \in [-2, 7], b \in [0, 2], c \in [0, 2]$, and $r \in [-13, -10]$.

C. $a \in [-2, 7], b \in [17, 25], c \in [40, 41]$, and $r \in [64, 71]$.

D. $a \in [-2, 7], b \in [2, 5], c \in [-11, -5]$, and $r \in [5, 9]$.

E. $a \in [-8, -6], b \in [-6, -3], c \in [-11, -5]$, and $r \in [-30, -25]$.

---

8. What are the *possible Rational* roots of the polynomial below?

$$f(x) = 7x^2 + 7x + 5$$

A. $\pm 1, \pm 7$

B. All combinations of: $\dfrac{\pm 1, \pm 5}{\pm 1, \pm 7}$

C. All combinations of: $\dfrac{\pm 1, \pm 7}{\pm 1, \pm 5}$

D. $\pm 1, \pm 5$

E. There is no formula or theorem that tells us all possible Rational roots.

---

9. Perform the division below. Then, find the intervals that correspond to the quotient in the form $ax^2 + bx + c$ and remainder r.

$$\frac{8x^3 + 6x^2 - 32x - 19}{x - 2}$$

A. $a \in [8, 10],\ b \in [18, 29],\ c \in [12, 16],$ and $r \in [4, 8]$.

B. $a \in [16, 19],\ b \in [-31, -20],\ c \in [16, 25],$ and $r \in [-59, -54]$.

C. $a \in [8, 10],\ b \in [13, 17],\ c \in [-22, -15],$ and $r \in [-39, -36]$.

D. $a \in [16, 19],\ b \in [30, 43],\ c \in [37, 48],$ and $r \in [65, 72]$.

E. $a \in [8, 10],\ b \in [-14, -8],\ c \in [-15, -7],$ and $r \in [4, 8]$.

---

10. Factor the polynomial below completely. Then, choose the intervals the zeros of the polynomial belong to, where $z_1 \leq z_2 \leq z_3$. *To make the problem easier, all zeros are between -5 and 5.*

$$f(x) = 15x^3 - 23x^2 - 58x - 24$$

A. $z_1 \in [-3.4, -2.1],\ z_2 \in [-0.39, 0.17],$ and $z_3 \in [3.38, 4.26]$

B. $z_1 \in [-1.7, -1.3],\ z_2 \in [-1.49, -1.12],$ and $z_3 \in [2.93, 3.49]$

C. $z_1 \in [-1, 0.4],\ z_2 \in [-1.03, -0.38],$ and $z_3 \in [2.93, 3.49]$

D. $z_1 \in [-3.4, -2.1],\ z_2 \in [0.52, 0.91],$ and $z_3 \in [0.31, 1.05]$

E. $z_1 \in [-3.4, -2.1],\ z_2 \in [1.13, 1.64],$ and $z_3 \in [1.47, 1.82]$
